

(19) World Intellectual Property  
Organization  
International Bureau



(43) International Publication Date  
22 July 2004 (22.07.2004)

PCT

(10) International Publication Number  
**WO 2004/062075 A3**

(51) International Patent Classification<sup>7</sup>: **H02M 7/5383**,  
H05B 39/04, H02M 3/338

(21) International Application Number:  
PCT/US2003/041512

(22) International Filing Date:  
31 December 2003 (31.12.2003)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data: **31 June 05**  
60/437,584 31 December 2002 (31.12.2002) US

(71) Applicant (for all designated States except US): **APOGEE TECHNOLOGY, INC.** [US/US]; 129 Morgan Drive, Norwood, MA 02062 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **TSUI, Ping** [US/US]; 42 Crestview Drive, Malden, MA 02148 (US).  
**DANIELSON, Michael, S.** [US/US]; 26 Arnold Street, Wrentham, MA 02093 (US).

(74) Agents: **QUINN, Joseph, P.** et al.; Brown Rudnick Berlack Israels LLP, One Financial Center, Boston, MA 02111 (US).

(81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States (regional): ARIPO patent (BW, GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

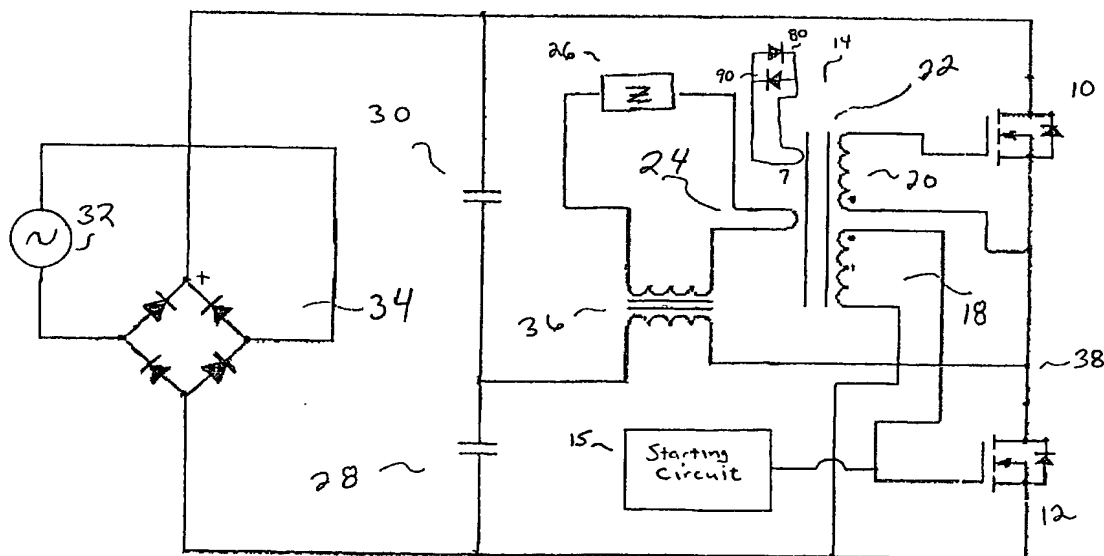
**Published:**

- with international search report
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

(88) Date of publication of the international search report:  
2 September 2004

[Continued on next page]

(54) Title: ADAPTIVE RESONANT SWITCHING POWER SYSTEM



(57) Abstract: A resonant switching power system operates with two resonant frequencies. A first frequency depends on the secondary leakage inductance of an output transformer and capacitor. The first frequency varies with changes in the load because load changes alter the leakage inductance. A second resonant frequency depends on the gate source capacitance of two MOSFET power devices in the circuit and the leakage inductance of the circuit's driving transformer. Power is thereby supplied that is always in phase with the load so that switching in the power supply occurs when current is near zero. High thermal efficiency is thereby achieved.

WO 2004/062075 A3



---

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

# INTERNATIONAL SEARCH REPORT

International Application No

PC 03/41512

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H02M7/5383 H05B39/04 H02M3/338

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H02M H05B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ, INSPEC, IBM-TDB

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	FR 2 759 240 A (KRS SA) 7 August 1998 (1998-08-07)  abstract figure 2 page 11, line 5 - page 12, line 21	1-7, 9-25, 28, 30
Y	US 5 430 632 A (MESZLENYI IVAN) 4 July 1995 (1995-07-04)  figures 1,2 abstract column 2, lines 13-24, 47-60 column 3, lines 60-65 column 4, lines 8-11	1-7, 9-25, 28, 30, 32
X	----- -/-	26, 27, 29, 31

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

### \* Special categories of cited documents :

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
- \*E\* earlier document but published on or after the international filing date
- \*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- \*O\* document referring to an oral disclosure, use, exhibition or other means
- \*P\* document published prior to the international filing date but later than the priority date claimed

- \*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- \*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- \*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- \* & \* document member of the same patent family

Date of the actual completion of the international search

1 July 2004

Date of mailing of the international search report

09/07/2004

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Zettler, K-R

# INTERNATIONAL SEARCH REPORT

International Application No

PCT 03/41512

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 3 215 951 A (ANDERSON WILMER C ET AL) 2 November 1965 (1965-11-02) column 2, lines 47-49; figure 1 column 3, lines 9-15	2,13,20, 25
Y	EP 1 130 752 A (MATSUSHITA ELECTRIC WORKS LTD) 5 September 2001 (2001-09-05) figures 1,43 paragraphs '0078!, '0079!, '0095!	3,15
Y	US 4 806 884 A (RUETT WINFRIED P) 21 February 1989 (1989-02-21) figure 3 column 4, lines 63-68 column 6, lines 13-31	6,11,18, 23
Y	US 5 341 068 A (NERONE LOUIS R) 23 August 1994 (1994-08-23) figure 1 column 5, lines 6-10	7,12,19, 24
Y	US 5 592 367 A (SUGIMORI KATSUNORI ET AL) 7 January 1997 (1997-01-07) figures 1,2 column 4, line 42 - column 5, line 34 column 5, lines 54-59	32
A	US 5 986 895 A (STEWART NEAL GEORGE ET AL) 16 November 1999 (1999-11-16) cited in the application abstract figure 1 column 2, lines 15-34 column 4, lines 11-36	1-32

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PC 03/41512

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
FR 2759240	A	07-08-1998	FR 2759240 A1	07-08-1998
US 5430632	A	04-07-1995	CA 2124370 A1	27-11-1995
			AU 2210295 A	21-12-1995
			WO 9533300 A1	07-12-1995
			DE 69504501 D1	08-10-1998
			DE 69504501 T2	08-04-1999
			EP 0761036 A1	12-03-1997
US 3215951	A	02-11-1965	DE 1194448 B	10-06-1965
			GB 1038052 A	03-08-1966
			US 3319185 A	09-05-1967
EP 1130752	A	05-09-2001	JP 2001238373 A	31-08-2001
			JP 2002078248 A	15-03-2002
			EP 1130752 A2	05-09-2001
			US 2001017781 A1	30-08-2001
US 4806884	A	21-02-1989	DE 3608871 C1	12-11-1987
			EP 0237930 A2	23-09-1987
US 5341068	A	23-08-1994	CA 2076127 A1	27-03-1993
			DE 69213632 D1	17-10-1996
			DE 69213632 T2	03-04-1997
			EP 0534727 A1	31-03-1993
			JP 2591886 B2	19-03-1997
			JP 5242977 A	21-09-1993
US 5592367	A	07-01-1997	JP 2833998 B2	09-12-1998
			JP 7337035 A	22-12-1995
US 5986895	A	16-11-1999	NONE	